

# Electrical Engineer

## At a Glance

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*Electrical engineers design and develop electrical parts, equipment, and systems. They work with the electrical energy in phones, power generators, and much more.*

### 16 Career Clusters

Information Technology

Manufacturing

Science, Technology, Engineering & Math

### Earnings

**Earnings Range:** 53K - 126K

### Level of Education

- 4-Year College or University

### Core Tasks

- Use computer programs to design products, components, or electrical systems
- Estimate quantities and cost of materials, equipment, and labor needed for projects
- Supervise manufacturing process
- Attend meetings to discuss and plan projects
- Test systems and equipment to make sure they perform as required

### Attributes & Abilities

- Math skills
- Analytical
- Detail-oriented
- Work well as part of a team
- An interest in solving problems with technology

### Workplace

- Most work for manufacturers of computer or electronic products, or for professional, scientific, and technical services firms
- Some work for electrical power generation companies
- A lot of work is done at a desk, in front of a computer
- Some respond to and solve problems on the factory or power plant floor
- Most work a 5-day, 40-hour week, but overtime is sometimes necessary

## Job Description

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Have you ever wondered how electricity gets from the power plant to your home? This is the work of electrical engineers. They design and maintain the systems that produce and transfer electrical energy. They work on a range of electrical products and systems. They deal with everything from cell phones to power generators.

These engineers use math and science to solve complex technical problems. They work in many fields. Some work for utility companies. They design systems that produce and transmit electricity. They may also fix the equipment at power plants.

Others work for manufacturing companies. They create all kinds of products. For example, they may design fuel cells that could one day power cars. Or, they may develop appliances that use less energy. Some design better ways to build those products.

Other engineers work in construction. They design the systems that run the lighting and heating for buildings. Some work in transportation. They design the signal systems that are used for roads and railways. They may work on some parts of vehicles. Some work in the field of robotics.

Whatever the field, a lot of engineers' duties are the same. They prepare technical drawings of products and systems. They use computer-aided design (CAD) software to create designs. They write performance requirements for their products. They attend meetings to discuss new projects. They estimate and write reports on the cost of new projects. They also test equipment to make sure it works.

Most engineers become experts in one area. For example, some focus on communications. Power generation and transmission is another option. Some only make electrical equipment. They can also specialize further within each of these fields.

## Working Conditions

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Electrical engineers work for:

- electrical equipment makers
- computer and electronics manufacturers
- governments
- telecommunications companies
- electrical utilities firms
- scientific and technical services firms

Engineers spend a lot of time at their desks. They often work in front of a computer. But they don't always work in an office. Sometimes they fix problems on the factory or power plant floor.

Some engineers work in the telecommunications field. They may have to travel to communications towers. There, they install or repair equipment. Those who work as consultants may travel even more. They visit the factories that belong to their clients. Those can be located across the country, or even around the world.

On the job, they use special tools and equipment. For example, they use computer-aided design (CAD) software. It allows them to create 3D images of their designs. They also use tools that test and measure electrical currents.

Most work 40 to 45 hours a week. They may have to work evenings and weekends to meet deadlines.

## Earnings

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Electrical engineers can earn between \$60,000 and \$149,000 a year. The median salary is about \$94,000 a year. Highly trained specialists and senior managers can earn more than \$150,000 a year.

Earnings depend on experience and education. Those with a bachelor's degree often earn less than those with a master's degree. As they take on more duties, they can make more money.

Most engineers who work full time get benefits as well as a salary. These can include health and dental coverage, paid sick days, and vacation days. They may also get payments towards a pension plan. Some get bonuses based on their performance.

### Massachusetts Wages

**Occupation:** Electrical Engineers

Level of Experience	Hourly	Annual
Entry Wage	\$39.26	\$81,670

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Median Wage	\$49.56	\$103,090
Experienced Wage	\$62.81	\$130,650

**Source:** U.S. Department of Labor, Bureau of Labor Statistics <http://www.bls.gov>

## Massachusetts Outlook

**Occupation:** Electrical Engineers

### Employment

2014	7,800
2024	7,890

### Change

Number	90
Percentage	1.2

### Annual Average Openings

Total	Growth	Replacement
180	--	--

**Source:** Projections Central <http://www.projectionscentral.com>

## Education

If you want to be an electrical engineer, take math and science courses in high school. English courses are also useful.

You need at least a bachelor's degree in electrical engineering. A degree in a related subject, like electronics engineering, may also be suitable. It will take you 4 years to earn a bachelor's degree.

In an undergraduate program, you learn how to design and build electrical systems. You will study:

- power electronics
- digital signal processing
- telecommunications systems
- semiconductor materials

Some schools offer co-op programs. In a co-op, you can apply what you learn in class to the real world. This helps you gain work experience.

Some jobs require just a bachelor's degree. However, you need a master's degree or PhD for other jobs. These include academic and advanced research jobs.

In graduate school, your studies are more specialized. For instance, you may focus on communications. Or you can study fields like fiber-optics or TV. Business courses are a good idea if you want to be a manager. You can even earn a Master of Business Administration (MBA) degree.

You need a license to work as a Professional Engineer (PE). After school, you need to get some experience on the job. You must work under the supervision of senior engineers for a few years. Then, you can register as a PE with your state licensing board.

It's always a good idea to keep learning after you start working. You can take ongoing education programs. Trade groups and equipment vendors often offer them. Courses will keep you updated on what's new in the field.

### Related College Programs

- Electrical and Electronics Engineering
- Electromechanical Engineering
- Mechatronics, Robotics, and Automation Engineering
- Electrical, Electronic and Communications Engineering Technology/Technician
- Electrical/Electronics Drafting and Electrical/Electronics CAD/CADD
- Electrical, Electronics and Communications Engineering, Other
- Pre-Engineering

### Other Suggested Qualifications

Overall, electrical engineers must have solid analytic, mathematical, and problem-solving skills. If you want to become an electrical engineer, you should be a logical thinker who pays attention to detail and works well in a team. You need to have good technical skills and a grasp of basic physics. Most importantly, you must be interested in solving problems through the use of technology.

### Sample High School Program of Study

This Program of Study can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals.

### Engineering and Technology Science, Technology, Engineering & Math

Grade 9	Grade 10	Grade 11	Grade 12
<b>English/Language Arts</b>			
English/Language Arts I	English/Language Arts II	English/Language Arts III	English/Language Arts IV
<b>Math</b>			
Algebra I or Geometry	Geometry or Algebra II	Algebra II or Trigonometry  Pre-Calculus or Statistics	Trigonometry or Pre-Calculus/Calculus or AP Calculus or Math Analysis
<b>Science</b>			
Biology	Chemistry	Physics	AP Science or Structured Computer Program Language

**Grade 9****Grade 10****Grade 11****Grade 12**

<b>Social Studies/Sciences</b>			
State History Civics	U.S. History	World History World Geography	Economics Entrepreneurship
<b>Career &amp; Technical Courses</b>			
Introduction to Engineering Design	Principles of Engineering or Information Technology Applications	Product Engineering and Development Digital Electronics	Civil Engineering and Architecture Engineering Innovation

States' Career Clusters Initiative, 2008, [www.careerclusters.org](http://www.careerclusters.org).

**Important**

- Check with your advisor to make sure that your course selections satisfy your graduation requirements.
- Courses available may vary from school to school.

**Sample Career Path**

People take different pathways through their careers, but no one starts at the top. This is an example of how the earnings, education and experience requirements, and responsibilities might progress for someone in this occupation.

**Level 1**

<b>Sample Title</b>	Trainee
<b>Earnings</b>	\$50,000 to \$60,000 a year
<b>Requirements</b>	• Bachelor's degree in electrical engineering
<b>Responsibilities</b>	Analyzing and designing simple projects under the guidance and supervision of a licensed engineer.

**Level 2**

<b>Sample Title</b>	Junior Engineer
<b>Earnings</b>	\$60,000 to \$80,000 a year
<b>Requirements</b>	• Approximately 2 years of experience as a trainee
<b>Responsibilities</b>	Analyzing and designing complex projects under limited supervision.

## Level 2

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## Level 3

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**Sample Title** Intermediate Engineer

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**Earnings** \$80,000 to \$90,000 a year

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**Requirements**

- Several years of experience as a licensed professional engineer
- Possibly a master's degree in a specific area of electric engineering

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**Responsibilities** Analyzing and designing large, complex projects; supervising trainees and junior engineers; performing limited administrative and managerial duties.

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## Level 4

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**Sample Title** Senior Engineer

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**Earnings** \$90,000 to \$105,000 a year

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**Requirements**

- Many years of experience as a licensed professional engineer

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**Responsibilities** Overseeing the analysis and design of several projects; supervising trainees and junior engineers; dealing with clients and government officials; performing administrative and managerial duties.

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## Level 5

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**Sample Title** Manager / Senior Partner

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**Earnings** \$100,000 to \$140,000 a year

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**Requirements**

- Possibly a master's degree in a specific area of electric engineering
- Master of Business Administration (MBA) degree, or some other business-related qualification

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**Responsibilities** Managing a large number of employees; pursuing new clients; ensuring that the organization is meeting its financial objectives; performing heavy administrative duties.

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## Related Careers

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Here are some other occupations that you might be interested in. Click on an occupation name to learn more.

- Aerospace Engineer
- Avionics Tech
- Biomedical Engineer
- Chemical Engineer

- Civil Engineer
- Computer Hardware Engineer
- Computer Scientist
- Computer Software Engineer
- Electrical Engineering Tech
- Electrician
- Electronics Engineer
- Electronics Engineering Tech
- Environmental Engineer
- Industrial Engineer
- Inventor
- Materials / Metallurgical Engineer
- Mechanical Engineer
- Nuclear Engineer

## Related Military Careers

- Electrical / Electronics Engineer

## Career Clusters

Career Clusters are groups or families of occupations that share common characteristics such as knowledge requirements, skill sets, and/or goals.

Information Technology

Manufacturing

Science, Technology, Engineering & Math

## National Employment by Industry

Industry	% Employed
Manufacturing	36
Professional, Scientific, and Technical Services	31
Utilities	10

Source: O\*Net Online, Browse by Industry, US Department of Labor  
<http://online.onetcenter.org/find/industry>

## Other Resources

### Institute of Electrical and Electronics Engineers USA (IEEE-USA)

A professional society for electrical and electronics engineers. Click on Careers for career planning information.

<http://www.ieeeusa.org>

### Science Buddies – Electrical & Electronics Engineer

This career profile offers some great basic information about the career, key requirements, job duties, and more.

<http://www.sciencebuddies.org/science-engineering-careers/engineering/electrical-electronics-engineer>

### TryEngineering.Org

Find helpful career and educational resources here. Be sure to explore the Become An Engineer section to

learn about engineering and engineering technology careers.  
<http://www.tryengineering.org>

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**ABET – Explore Technical Careers**

ABET accredits post-secondary programs in engineering and technology and promotes a high quality in education. Here you can discover different career options.  
<http://www.ecei.org/explore-technical-careers>

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**eGFI – Dream Up the Future**

The American Society for Engineering Education (ASEE) created this website for students interested in learning more about engineering and engineering careers.  
<http://www.egfi-k12.org>

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**Discover Engineering**

A website designed for students to introduce them to the world of engineering.  
<http://www.discoverengineering.org>

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**Engineer Your Life**

This website is designed to provide a guide to engineering for high school girls. Click on Find Your Dream Job to read about the different engineering disciplines.  
<http://www.engineeryourlife.org>

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**Engineering Schools – Top 10 Qualities of a Great Engineer**

Find out what qualities are needed to be a successful engineer!  
<http://www.engineeringschools.com/resources/top-10-qualities-of-a-great-engineer>

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**Occupational Outlook Handbook – Electrical and Electronics Engineers**

Career information from the US Department of Labor.  
<http://www.bls.gov/ooh/architecture-and-engineering/electrical-and-electronics-engineers.htm>